This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (previously presented): Apparatus for use in a mobile user unit in an orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless system including at least two adjacent base stations, each one of the adjacent base stations transmitting pilot tones according to one of a plurality of different pilot tone hopping sequences over at least a portion of a pilot sequence transmission time period, said portion including multiple symbol time periods, at least one of the different pilot tone hopping sequences including at least two pilot tones per symbol time period which are separated from one another by at least one tone during said portion of said pilot sequence transmission time period, in each of the different pilot tone hopping sequences the number of pilot tones used in each successive symbol time periods in said portion of said pilot sequence transmission period being the same but the tones used in a symbol time period by any one of the different pilot tone hopping sequences changing in frequency from one symbol time period to the next symbol time period by a frequency shift corresponding to a fixed number of tones, adjacent base stations using different frequency shifts to generate pilot tone hopping sequences with different pilot tone slopes which can be determined from the frequency shift of the pilot tones used in consecutive symbol time periods, the apparatus comprising:

a receiver for receiving one or more of said plurality of different pilot tone hopping sequences having different pilot tone slopes; and

a detector, responsive to said one or more received pilot tone hopping sequences, said detector including an energy accumulator for generating an accumulated energy measurement for each individual one of the plurality of pilot tone hoping sequences having different slopes over a period including multiple symbol time periods, said detector detecting a received pilot tone hopping sequence having the maximum accumulated energy over said period including multiple symbol time periods.

Claim 2 (previously presented): The invention as defined in claim 1 wherein each of said one or more received pilot tone hopping sequences is a Latin Squares based pilot tone hopping sequence.

Claim 3 (previously presented): The invention as defined in claim 1 wherein said receiver yields a baseband version of a received signal and further includes a unit for generating a fast Fourier transform version of said baseband signal, and wherein said detector is supplied with said fast Fourier transform version of said baseband signal to detect, based on accumulated energy measurements, the received pilot tone sequence having the maximum accumulated energy.

Claim 4 (original): The invention as defined in claim 3 wherein said receiver further includes a quantizer for quantizing the results of said fast Fourier transform.

Claim 5 (original): The invention as defined in claim 3 wherein said detector is a maximum energy detector.

Claim 6 (previously presented): The invention as defined in claim 5, wherein different initial frequency shifts are possible for different pilot tone hopping sequences having the same slope; and wherein said maximum energy detector determines a slope and an initial frequency shift for pilot tones in the detected pilot tone hopping sequence having the maximum accumulated energy.

Claim 7 (previously presented): Apparatus for use in a mobile user unit in an orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless system comprising:

a receiver for receiving one or more pilot tone hopping sequences each including pilot tones, said pilot tones each being generated at a prescribed frequency and time instants in a prescribed time-frequency grid; and

a maximum energy detector, responsive to said one or more received pilot tone hopping sequences, for detecting the received pilot tone hopping sequence having the strongest power,

said maximum energy detector including a slope-shift accumulator for accumulating energy along each possible slope and initial frequency shift of said one or more received pilot tone hopping sequences and generating an accumulated energy signal, a frequency shift accumulator supplied with said accumulated energy signal for accumulating energy along pilot frequency shifts of said one or more received pilot tone hopping sequences, and a maximum detector supplied with an output from said frequency shift accumulator for estimating a slope and initial frequency shift of the strongest received pilot

tone hopping sequence as a slope and initial frequency shift corresponding to the strongest accumulated energy.

Claim 8 (original): The invention as defined in claim 7 wherein said accumulated energy is represented by the signal $J_0(s,b_0)$, where $J_0(s,b_0)=\sum_{t=0}^{N_{sp}-1}|Y(t,st+b_0(\mathrm{mod}\,N))|^2$, and s is the slope of the pilot signal, b_0 is an initial frequency shift of the pilot signal, $Y(t,n)$ is the fast Fourier transform data, $t = 0,\ldots, N_{sp}-1$, $n = st+ b_0 (\mathrm{mod}\ N)$, and $n = 0,\ldots N-1$.

Claim 9 (original): The invention as defined in claim 7 wherein said frequency shift accumulator accumulates energy along pilot frequency shifts of said one or more received pilot tone hopping sequences in accordance with $J(s,b_0)=\sum_{j=1}^{N_p}J_0(s,b_0+n_j)$, where s is the slope of the pilot signal, b_0 is an initial frequency shift of the pilot signal and n_j are frequency offsets.

Claim 10 (original): The invention as defined in claim 7 wherein said maximum detector estimates said slope and initial frequency shift of the strongest received pilot tone hopping sequence in accordance with $\hat{s},\hat{b}_0=\arg\max_{s,b_0} J(s,b_0)$, where $\hat{s}$ is the estimate of the slope, $\hat{b}_0$ is the estimate of the initial frequency shift, and where the maximum is taken over $s\in S$ and $b_0=0,\ldots,N-1$.

Claim 11 (previously presented): Apparatus for use in a mobile user unit in an orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless system comprising:

a receiver for receiving one or more pilot tone hopping sequences each including pilot tones, said pilot tones each being generated at a prescribed frequency and time instants in a prescribed time-frequency grid; and

a maximum energy detector, responsive to said one or more received pilot tone hopping sequences, for detecting the received pilot tone hopping sequence having the strongest power, said maximum energy detector including a frequency shift detector for estimating at a given time frequency shift of the received pilot tone hopping sequence having strongest energy and an estimated maximum energy value, and a slope and frequency shift solver, responsive to said estimated frequency shift and said estimated maximum energy value, for generating estimates of an estimated slope and an estimated initial frequency shift of the strongest received pilot signal.

Claim 12 (original): The invention as defined in claim 11 wherein said estimated frequency shift at time t is obtained in accordance with $n(t) = st + b_0 (\mathrm{mod}\, N)$, where s is the pilot signal slope, t is a symbol time and $n(t)$ is a frequency shift estimate.

Claim 13 (original): The invention as defined in claim 12 wherein said estimated maximum energy value is obtained in accordance with $[E(t), n(t)] = \max_n \sum_{j=1}^{N_p} | Y(t, n + n_j (\mathrm{mod}\, N)) |^2$, where $E(t)$

is the maximum energy value, $Y(t,n)$ is the fast Fourier transform data, $j=1,\dots,N_p$ and n_j are frequency offsets.

Claim 14 (original): The invention as defined in claim 13 wherein said slope is estimated in accordance with $\hat{s} = \arg\max_{s \in S} \sum_{t=1}^{N_{sy}-1} E(t)\mathbf{1}_{\{n(t)-n(t-1)=s\}}$, where both $n(t)$ and $n(t-1)$ satisfy $n(t) = st + b_0 (\mathrm{mod}\, N)$.

Claim 15 (original): The invention as defined in claim 13 wherein said frequency shift is estimated in accordance with $\hat{b}_0 = \arg\max_{b_0=0,\dots,N-1} \sum_{t=0}^{N_{sy}-1} E(t)\mathbf{1}_{\{n(t)=st+b_0\}}$.

Claim 16 (original): The invention as defined in claim 11 wherein said maximum energy detector detects said slope in accordance with determining the time, $t_0 \in T$, and slope, $s_0 \in S$, such that the set of times t on the line $n(t) = n(t_0) + s_0(t - t_0)$, has the largest total pilot signal energy.

Claim 17 (previously presented): A method for use in a mobile user unit in an orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless system including at least two adjacent base stations, each one of the adjacent base stations transmitting pilot tones according to one of a plurality of different pilot tone hopping sequences, in each of the different pilot tone hopping sequences over at least a portion of a pilot sequence transmission time period, said portion including multiple symbol time periods, the number

of pilot tones used in each successive symbol time period in said portion of said pilot sequence transmission time period being the same but the tones used in a symbol time period by any one of the different pilot tone hopping sequences changing in frequency from one symbol time period to the next symbol time period by a frequency shift corresponding to a fixed number of tones, adjacent base stations using different frequency shifts to generate pilot tone hoping sequences with different pilot tone slopes which can be determined from the frequency shift of the pilot tones used in consecutive symbol time periods, the method comprising the steps of:

receiving one or more of said plurality of different pilot tone hopping sequences having different pilot tone hopping slopes; and

in response to said one or more received pilot tone hopping sequences:

generating an accumulated energy measurement for each individual one of the plurality of pilot tone hoping sequences having different pilot tone hopping slopes over a period including multiple symbol time periods; and

detecting a received pilot tone hopping sequence having the maximum accumulated energy over said period including multiple symbol time periods.

Claim 18 (previously presented): The method as defined in claim 17 wherein each of said one or more received pilot tone hopping sequences is a Latin Squares based pilot tone hopping sequence.

Claim 19 (previously presented): The method as defined in claim 17 wherein said step of receiving yields a baseband

version of a received signal and further including a step of generating a fast Fourier transform version of said baseband signal, and wherein said step of detecting is responsive to said fast Fourier transform version of said baseband signal for detecting the received pilot tone sequence having the maximum accumulated energy.

Claim 20 (original): The method as defined in claim 19 wherein said step of receiving further includes a step of quantizing the results of said fast Fourier transform.

Claim 21 (original): The method as defined in claim 19 wherein said step of detecting detects a maximum energy.

Claim 22 (previously presented): The method as defined in claim 21 wherein said step of detecting said maximum energy includes a step of determining a slope and initial frequency shift of pilot tones in a detected pilot tone hopping sequence having the maximum accumulated energy.

Claim 23 (previously presented): A method for use in a mobile user unit in an orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless system comprising the steps of:

receiving one or more pilot tone hopping sequences each including pilot tones, said pilot tones each being generated at a prescribed frequency and time instants in a prescribed time-frequency grid; and

in response to said one or more received pilot tone hopping sequences, detecting the received pilot tone hopping sequence having the maximum energy, said step of detecting said maximum energy including the steps of

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accumulating energy along each possible slope and initial frequency shift of said one or more received pilot tone hopping sequences and generating an accumulated energy signal, in response to said accumulated energy signal, accumulating energy along pilot frequency shifts of said one or more received pilot tone hopping sequences, and in response to an output from said step of frequency shift accumulating, estimating a slope and initial frequency shift of the strongest received pilot tone hopping sequence as a slope and initial frequency shift corresponding to the strongest accumulated energy.

Claim 24 (original): The method as defined in claim 23 wherein said accumulated energy is represented by the signal $J_0(s,b_0)$, where $J_0(s,b_0)=\sum_{t=0}^{N_{sy}-1} |Y(t,st+b_0(\mathrm{mod}\,N))|^2$, and s is the slope of the pilot signal, b_0 is an initial frequency shift of the pilot signal, $Y(t,n)$ is the fast Fourier transform data, $t = 0, \ldots, N_{sy}-1$, $n = st+b_0 (\mathrm{mod}\ N)$, and $n = 0, \ldots N-1$.

Claim 25 (original): The method as defined in claim 23 wherein said step of frequency shift accumulating includes a step of accumulating energy along pilot frequency shifts of said one or more received pilot tone hopping sequences in accordance with $J(s,b_0)=\sum_{j=1}^{N_r} J_0(s,b_0+n_j)$, where s is the slope of the pilot signal, b_0 is an initial frequency shift of the pilot signal and n_j are frequency offsets.

Claim 26 (original): The method as defined in claim 23 wherein said step of maximum energy detecting includes a step of estimating said slope and initial frequency shift of the strongest received pilot tone hopping sequence in accordance with $\hat{s},\hat{b}_0 = \arg\max_{s,b_0} J(s,b_0)$, where $\hat{s}$ is the estimate of the slope, $\hat{b}_0$ is the estimate of the initial frequency shift, and where the maximum is taken over $s \in S$ and $b_0 = 0,\ldots,N-1$.

Claim 27 (previously presented): A method for use in a mobile user unit in an orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless system comprising the steps of:

receiving one or more pilot tone hopping sequences each including pilot tones, said pilot tones each being generated at a prescribed frequency and time instants in a prescribed time-frequency grid; and

in response to said one or more received pilot tone hopping sequences, detecting the received pilot tone hopping sequence having maximum energy, said step of detecting the received pilot tone hopping sequence having maximum energy including a step of estimating, at a given time, a frequency shift of the received pilot tone hopping sequence having maximum energy and estimating a maximum energy value, and in response to said estimated frequency shift and said estimated maximum energy value, generating estimates of an estimated slope and an estimated initial frequency shift of the strongest received pilot signal.

Claim 28 (original): The method as defined in claim 27 wherein said estimated frequency shift at time t is obtained in accordance with $n(t) = st + b_0 (\mathrm{mod}\, N)$, where s is the pilot signal slope, t is a symbol time and $n(t)$ is a frequency shift estimate.

Claim 29 (original): The method as defined in claim 28 wherein said estimated maximum energy value is obtained in accordance with $[E(t), n(t)] = \max_{n} \sum_{j=1}^{N_p} | Y(t, n + n_j (\mathrm{mod}\, N)) |^2$, where $E(t)$ is the maximum energy value, $Y(t,n)$ is the fast Fourier transform data, $j = 1, \ldots, N_p$ and n_j are frequency offsets.

Claim 30 (original): The method as defined in claim 29 wherein said slope is estimated in accordance with $\hat{s} = \arg\max_{s \in S} \sum_{t=1}^{N_{sy}-1} E(t) \mathbf{1}_{\{n(t)-n(t-1)=s\}}$, where both $n(t)$ and $n(t-1)$ satisfy $n(t) = st + b_0 (\mathrm{mod}\, N)$.

Claim 31 (original): The method as defined in claim 29 wherein said frequency shift is estimated in accordance with $\hat{b}_0 = \arg \max_{b_0 = 0, \ldots, N-1} \sum_{t=0}^{N_{sy}-1} E(t) \mathbf{1}_{\{n(t)=st+b_0\}}$.

Claim 32 (original): The method as defined in claim 27 wherein said step of maximum energy detecting includes a step of finding the time, $t_0 \in T$, and slope, $s_0 \in S$, such that the set of times t on the line $n(t) = n(t_0) + s_0 (t - t_0)$, has the largest total pilot signal energy.

Claim 33 (previously presented): Apparatus for use in a mobile user unit in an orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless system including at least two adjacent base stations, each one of the adjacent base stations transmitting pilot tones according to one of a plurality of different pilot tone hopping sequences over at least a portion of a pilot sequence transmission time period, said portion including multiple symbol time periods, at least one of the different pilot tone hopping sequences including at least two pilot tones per symbol time period which are separated from one another by at least one tone during said portion of said pilot sequence transmission time period, in each of the different pilot tone hopping sequences the number of pilot tones used in each successive symbol time period in said portion of said pilot sequence transmission time period being the same but the tones used in a symbol time period by any one of the different pilot tone hopping sequences changing in frequency from one symbol time period to the next symbol time period by a frequency shift corresponding to a fixed number of tones, adjacent base stations using different frequency shifts to generate pilot tone hopping sequences with different pilot tone slopes which can be determined from the frequency shift of the pilot tones used in consecutive symbol time periods, the apparatus comprising:

means for receiving one or more of said different pilot tone hopping sequences each including pilot tones; and

means, responsive to said one or more received pilot tone hopping sequences, for generating an accumulated energy measurement for each individual one of the plurality

of different pilot tone hoping sequences having different pilot tone slopes; and

detector means for detecting a received pilot tone hopping sequence having the maximum accumulated energy over a period including multiple symbol time periods.

Claim 34 (previously presented): The invention as defined in claim 33 wherein each of said one or more received pilot tone hopping sequences is a Latin Squares based pilot tone hopping sequence.

Claim 35 (previously presented): The invention as defined in claim 33 wherein said means for receiving yields a baseband version of a received signal and further including means for generating a fast Fourier transform version of said baseband signal, and wherein said means for detecting is responsive to said fast Fourier transform version of said baseband signal for determining a received pilot tone sequence having the maximum energy.

Claim 36 (original): The invention as defined in claim 35 wherein said means for generating said fast Fourier transform includes means for quantizing the results of said fast Fourier transform.

Claim 37 (original): The invention as defined in claim 35 wherein means for detecting detects a maximum energy.

Claim 38 (previously presented): The invention as defined in claim 37 wherein said means for detecting said maximum energy includes means for determining a slope and an

initial frequency shift of pilot tones in a detected pilot tone hopping sequence having the maximum energy.

Claim 39 (currently amended): Apparatus for use in a mobile user unit in an orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless system comprising the steps of:

means for receiving one or more pilot tone hopping sequences each including pilot tones, said pilot tones each being generated at a prescribed frequency and time instants in a prescribed time-frequency grid; and

means, responsive to said one or more received pilot tone hopping sequences, for detecting the received pilot tone hopping sequence having maximum energy, said means for detecting said maximum energy including means for accumulating energy along each possible slope and initial frequency shift of said one or more received pilot tone hopping sequences, means for generating an accumulated energy signal, means, responsive to said accumulated energy signal, for accumulating energy along pilot frequency shifts of said one or more received pilot tone hopping sequences, and means, responsive to an output from said means for frequency shift accumulating, for estimating a slope and an initial frequency shift of the strongest received pilot tone hopping sequence as the slope and the initial frequency shift corresponding to the strongest accumulated energy.

Claim 40 (original): The invention as defined in claim 39 wherein said accumulated energy is represented by the signal $J_0(s,b_0)$, where $J_0(s,b_0)=\sum_{t=0}^{N_{pr}-1}|Y(t,st+b_0(\mathrm{mod}\,N))|^2$, and s is

the slope of the pilot signal, b_0 is an initial frequency shift of the pilot signal, $Y(t,n)$ is the fast Fourier transform data, $t = 0,\ldots N_{sy}-1$, $n = st+ b_0 \pmod N$, and $n = 0,\ldots N-1$.

Claim 41 (original): The invention as defined in claim 39 wherein said means for frequency shift accumulating includes means for accumulating energy along pilot frequency shifts of said one or more received pilot tone hopping sequences in accordance with $J(s,b_0)=\sum_{j=1}^{N_C} J_0(s,b_0+n_j)$, where s is the slope of the pilot signal, b_0 is an initial frequency shift of the pilot signal and n_j are frequency offsets.

Claim 42 (original): The invention as defined in claim 39 wherein said means for maximum energy detecting includes means for estimating said slope and initial frequency shift of the strongest received pilot tone hopping sequence in accordance with $\hat{s},\hat{b}_0 = \arg\max_{s,b_0} J(s,b_0)$, where $\hat{s}$ is the estimate of the slope, $\hat{b}_0$ is the estimate of the initial frequency shift, and where the maximum is taken over $s \in S$ and $b_0 = 0,\ldots,N-1$.

Claim 43 (previously presented): Apparatus for use in a mobile user unit in an orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless system comprising the steps of:

means for receiving one or more pilot tone hopping sequences each including pilot tones, said pilot tones each being generated at a prescribed frequency and time instants in a prescribed time-frequency grid; and

means, responsive to said one or more received pilot tone hopping sequences, for detecting the received pilot tone hopping sequence having maximum energy, said means for detecting said maximum energy including means for estimating at a given time a frequency shift of the received pilot tone hopping sequence having maximum energy and for estimating a maximum energy value, and means, responsive to said estimated frequency shift and said estimated maximum energy value, for generating estimates of an estimated slope and an estimated initial frequency shift of the strongest received pilot signal.

Claim 44 (original): The invention as defined in claim 43 wherein said estimated frequency shift at time t is obtained in accordance with $n(t) = st + b_0 (\bmod N)$, where s is the pilot signal slope, t is a symbol time and $n(t)$ is a frequency shift estimate.

Claim 45 (original): The invention as defined in claim 44 wherein said estimated maximum energy value is obtained in accordance with $[E(t), n(t)] = \max_{n} \sum_{j=1}^{N_p} | Y(t, n + n_j (\bmod N)) |^2$, where $E(t)$ is the maximum energy value, $Y(t,n)$ is the fast Fourier transform data, $j = 1, \ldots, N_p$ and n_j are frequency offsets.

Claim 46 (original): The invention as defined in claim 45 wherein said slope is estimated in accordance with

$\hat{s} = \arg\max_{s \in S} \sum_{t=1}^{N_{sy}-1} E(t)\mathbf{1}_{\{n(t)-n(t-1)=s\}}$, where both $n(t)$ and $n(t-1)$ satisfy

$n(t) = st + b_0 (\bmod N)$.

Claim 47 (original): The invention as defined in claim 45 wherein said frequency shift is estimated in accordance with $\hat{b}_0 = \arg\max_{b_0=0,\dots,N-1} \sum_{t=0}^{N_{sy}-1} E(t)\mathbf{1}_{\{n(t)=st+b_0\}}$.

Claim 48 (original): The invention as defined in claim 43 wherein said means for detecting maximum energy includes means for finding the time, $t_0 \in T$, and slope, $s_0 \in S$, such that the set of times t on the line $n(t) = n(t_0) + s_0(t - t_0)$, has the largest total pilot signal energy.

Claim 49 (previously presented): The method of claim 1, wherein frequency spacing between pilot tones which occur in a symbol time period in each of said plurality of tone hopping sequences is fixed and is the same for all of said plurality of pilot tone hopping sequences.

Claim 50 (previously presented): An orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless system comprising:

at least two adjacent base stations, each one of the adjacent base stations transmitting pilot tones according to one of a plurality of different pilot tone hopping sequences over at least a portion of a pilot sequence transmission time period, said portion including multiple symbol time periods, at least one of the different pilot

tone hopping sequences including at least two pilot tones per symbol time period which are separated from one another by at least one tone during said portion of said pilot sequence transmission time period, in each of the different pilot tone hopping sequences the number of pilot tones used in each successive symbol time period in said portion of said pilot sequence transmission period being the same but the tones used in a symbol time period by any one of the different pilot tone hopping sequences changing in frequency from one symbol time period to the next symbol time period by a frequency shift corresponding to a fixed number of tones, adjacent base stations using different frequency shifts to generate pilot tone hopping sequences with different pilot tone slopes which can be determined from the frequency shift of the pilot tones used in consecutive symbol time periods; and

a mobile communications device including:

i) a receiver for receiving one or more of said plurality of different pilot tone hopping sequences; and

ii) means for determining the pilot tone slope of a received pilot tone hopping sequence.

Claim 51 (previously presented): An orthogonal frequency division multiplexing (OFDM) based spread spectrum multiple access wireless communications method, comprising:

at least two adjacent bases stations which transmit pilot tones according to different ones of a plurality of different pilot tone hopping sequences over at least a portion of a pilot sequence transmission time period, said portion including multiple symbol time periods, at least one of the different pilot tone hopping sequences including at least two pilot tones per symbol time period which are

separated from one another by at least one tone during said portion of said pilot sequence transmission time period, in each of the different pilot tone hopping sequences the number of pilot tones used in each successive symbol time period in said portion of said pilot sequence transmission period being the same but the tones used in a symbol time period by any one of the different pilot tone hopping sequences changing in frequency from one symbol time period to the next symbol time period by a frequency shift corresponding to a fixed number of tones, each of the adjacent base stations using different frequency shifts to generate the transmitted pilot tone hopping sequences resulting in different pilot tone slopes which can be determined from the frequency shift of the pilot tones transmitted in consecutive symbol time periods.

Claim 52 (previously presented): The method of claim 51, wherein frequency spacing between pilot tones which occur in a symbol time period in each of said plurality of tone hopping sequences is fixed and is the same for all of said plurality of pilot tone hopping sequences.